Thermo-optical Sound Generation in Heterogeneous Media by Bessel Light Beams

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The processes of dissipation of energy from Bessel light beams in heterogeneous media are discussed. These processes lead to the excitation and generation of thermoelastic oscillations. Bessel light beams find a wide application in various scientific and technological problems. For example, they can be used during the generation of the second, third and higher harmonics in crystal and gaseous media, parametric transformation of the frequency, and manipulation of nanoparticles in organic cells and their components. The other peculiarities of Bessel light beams represent certain interests for the purposes of ultrasonic nondestructive control, echoscopes, optoacoustics of biological media, etc. For the description and analysis of thermooptical sound excitation in condensed media, we used the method of Green functions. The solution of the equation describing a thermooptical transformation in the condensed layered medium was carried out based on this method. The distribution of the temperature fields and thermoelastic tensions on the boundary of the heterogeneous sample were determined.

Comparison by numerical and graphical analysis of the efficiency of the thermooptical transformation during the irradiation of the condensed heterogeneous medium by plane light waves and Bessel light beams has been carried out. It was shown that the application of Bessel light beams is more convenient in comparison with plane light waves in a series of particular cases. This property of Bessel laser beams can be used for increasing the sounding depth of heterogeneous media, nanostructures and biological objects by the methods of laser photoacoustic spectroscopy.